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Lee et al.

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(54) **BRAKE DRIVING APPARATUS**

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B60T 15/02 (2006.01)
F15B 13/08 (2006.01)

(52) **U.S. Cl.**
CPC ***B60T 8/36*** (2013.01); ***B60T 15/028*** (2013.01); ***F15B 13/0853*** (2013.01)

(58) **Field of Classification Search**
CPC B60T 15/028; B60T 13/686; B60T 8/3685; B60T 13/66
See application file for complete search history.

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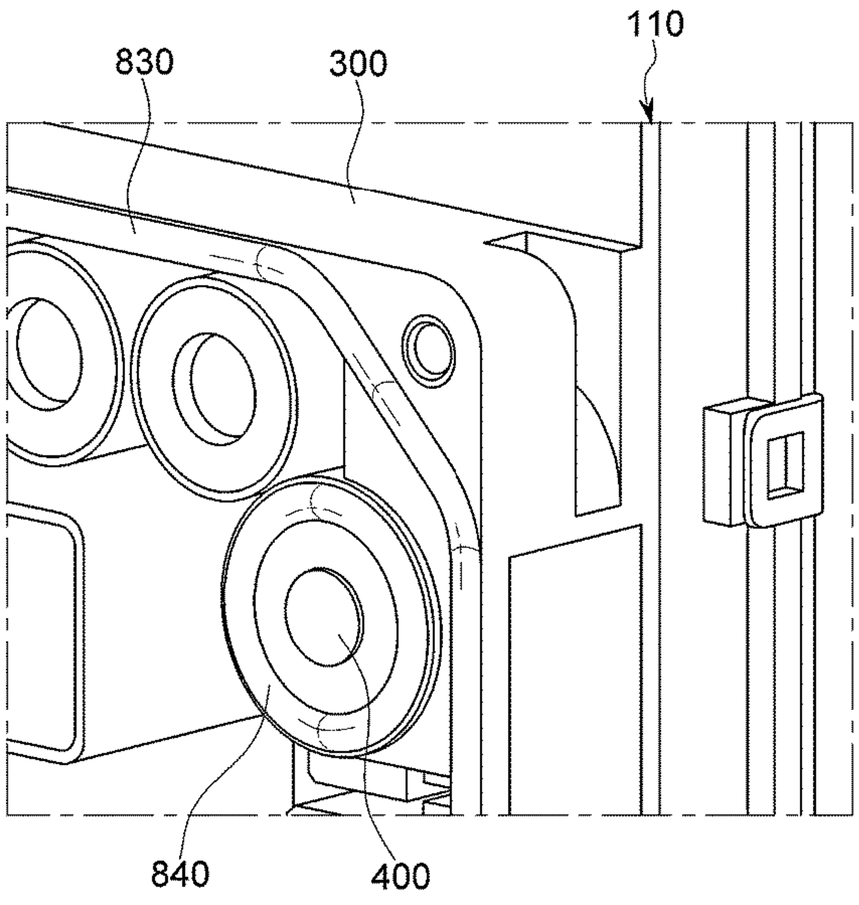
(57) **ABSTRACT**

A brake driving apparatus includes a hydraulic valve block including a vent channel for discharging air to the outside, an electronic control device that includes an electrical component housing open in a direction of the vent channel of the hydraulic valve block and having a ventilation hole connected to an internal space and a filter attached to the electrical component housing to block the ventilation hole so that air can pass therethrough, and is supported by one side of the hydraulic valve block, and a vent sealing member that seals a space between the hydraulic valve block and the electronic control device and surrounds the vent channel, the ventilation hole, and the filter.

6 Claims, 5 Drawing Sheets



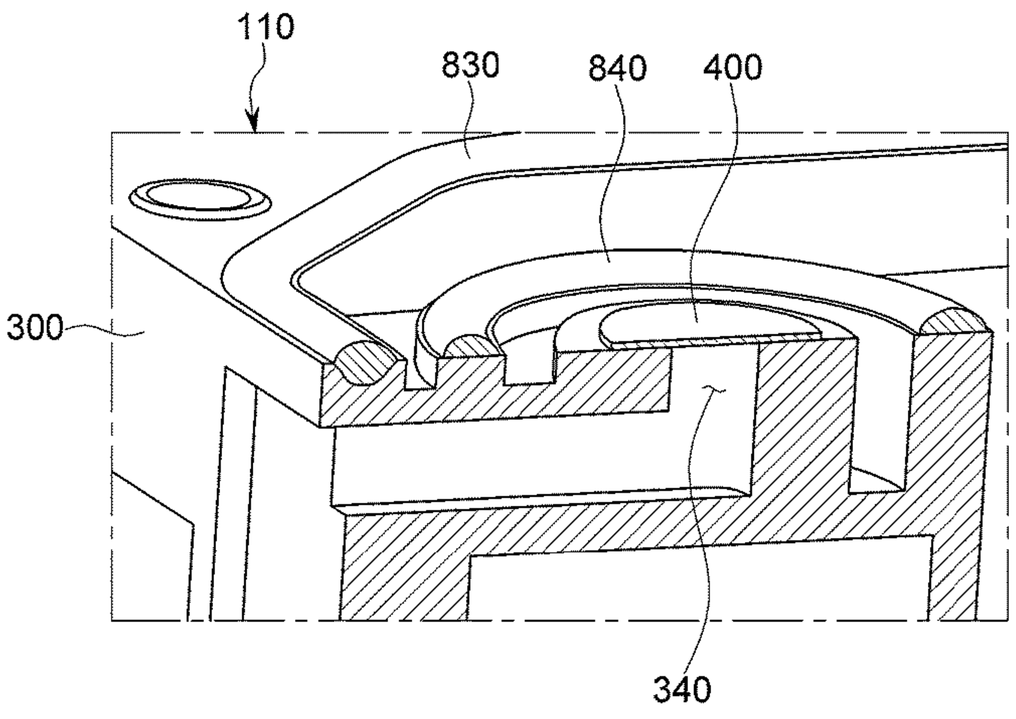


Fig. 1

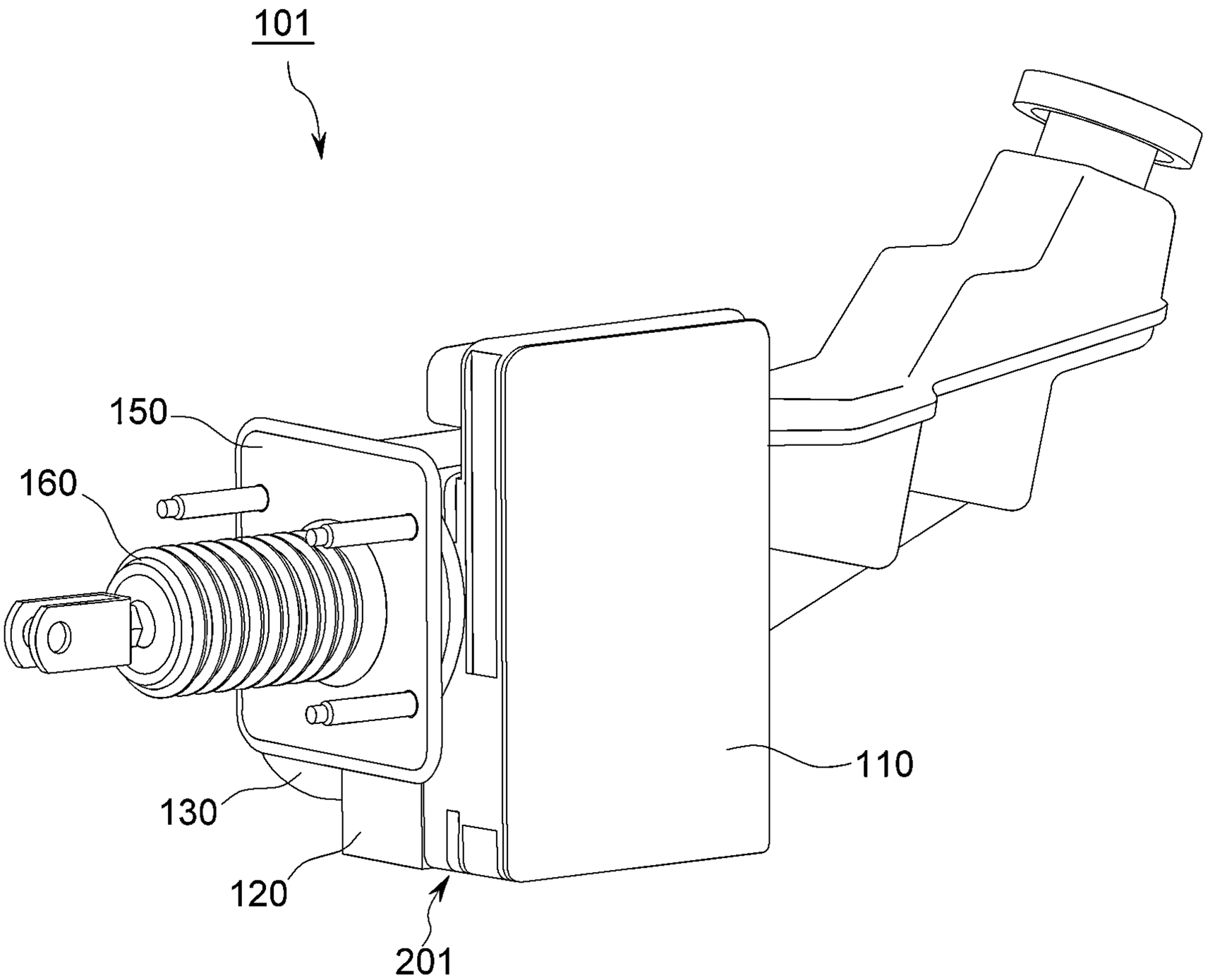


Fig. 2

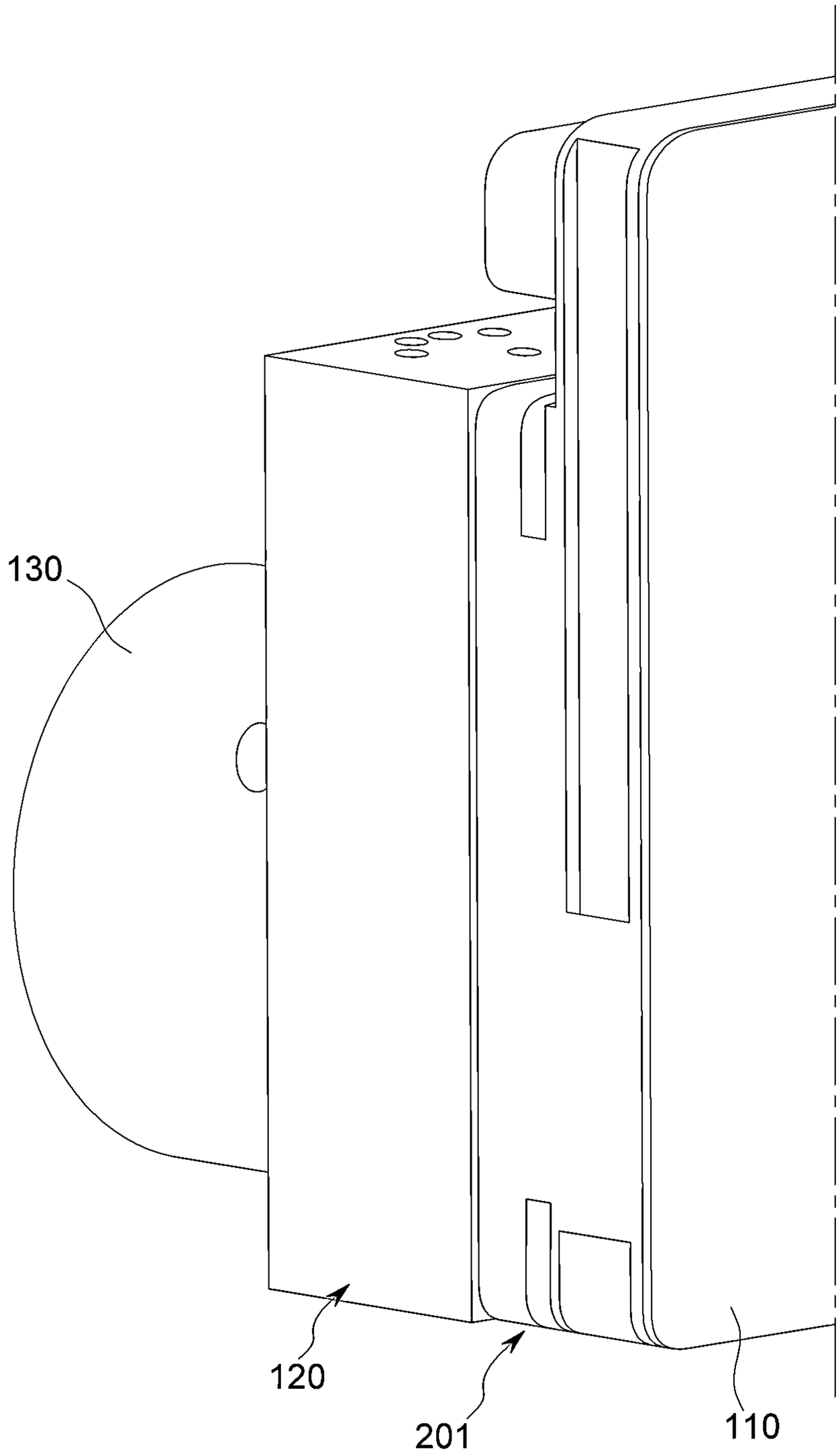


Fig. 3

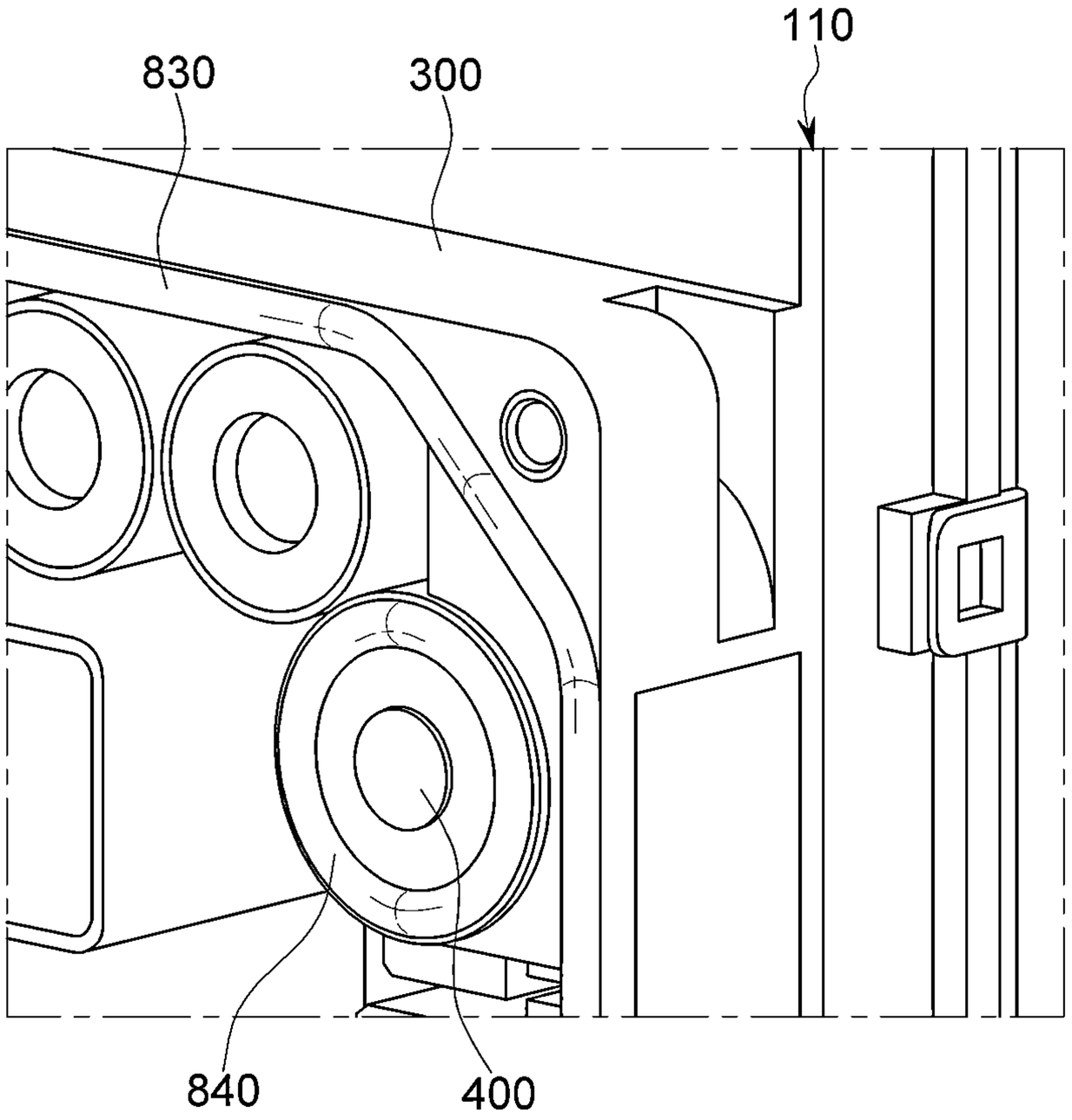


Fig. 4

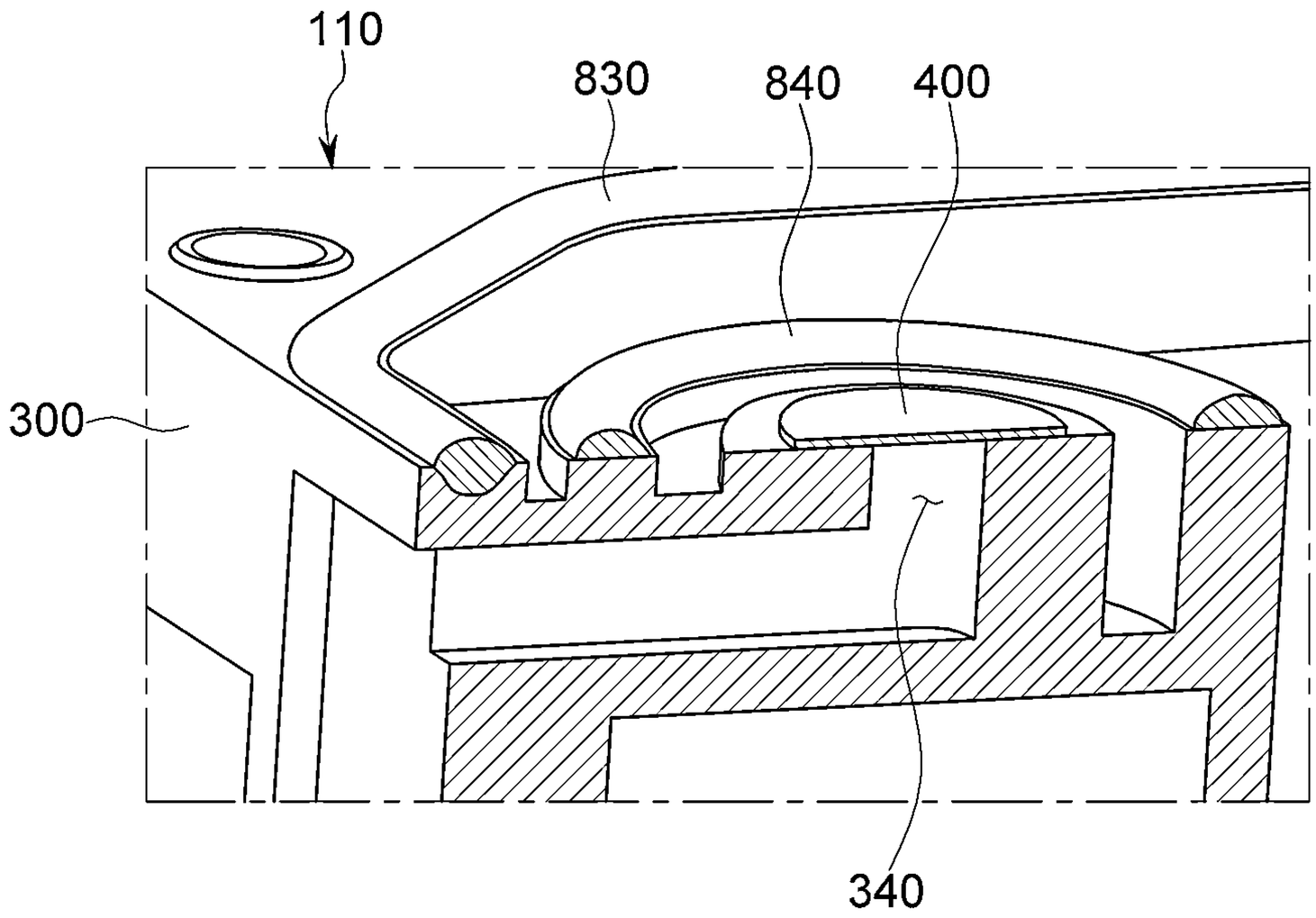
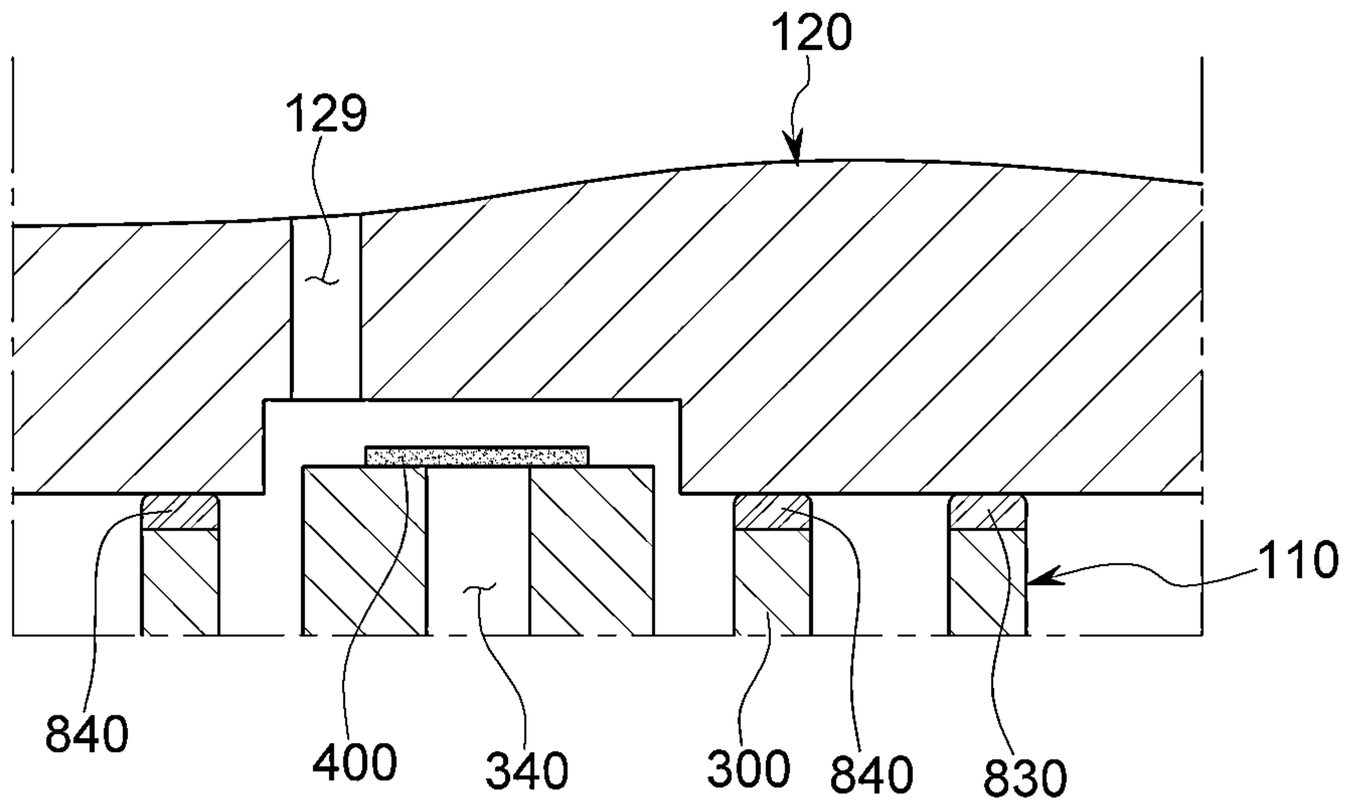


Fig. 5



BRAKE DRIVING APPARATUS

CROSS REFERENCE TO RELATED APPLICATION

This application claims priority from and the benefits of Korean Patent Application No. 10-2022-0031894, filed on Mar. 15, 2022, which is all hereby incorporated by reference in its entirety.

TECHNICAL FIELD

The present disclosure generally relates to a brake driving apparatus, and more particularly, to a brake driving apparatus capable of preventing a change in internal pressure due to a temperature change of one or more of an electronic control device and an electric motor.

BACKGROUND

In general, a brake driving apparatus provides a braking force to a brake according to a pedal effort of a driver of a vehicle stepping on a brake pedal. In addition, the brake reduces a speed of the vehicle by reducing a rotational speed of a wheel according to the received braking force, thereby braking the vehicle. The magnitude of this braking force is changed according to the pedal effort through switching and positioning of a plurality of solenoid valves by hydraulic pressure.

Meanwhile, in the case of a brake driving apparatus requiring a compact size due to a limited installation space, an internal pressure easily rises due to a temperature rise during an operation of an electric motor that generates a braking force. Moreover, when the internal pressure rises excessively, the electric motor may be damaged or oil leakage may occur.

Moreover, in the case of an electronic control device that controls a driving motor, the internal pressure may easily rise due to heat generated by a printed circuit board, and when the internal pressure rises excessively, the electronic control device may be damaged.

As described above, when the internal pressure rises due to the temperature change of the electric motor and electronic control device, which are the main parts of the brake driving apparatus, there are problems that the overall lifespan of the brake driving apparatus is reduced and the replacement cycle of parts is shortened.

SUMMARY

One embodiment of the present disclosure provides a brake driving apparatus capable of stably maintaining the equilibrium of internal pressure.

According to an aspect of the present disclosure, there is provided a brake driving apparatus including: a hydraulic valve block including a vent channel for discharging air to the outside; an electronic control device that includes an electrical component housing open in a direction of the vent channel of the hydraulic valve block and having a ventilation hole connected to an internal space and a filter attached to the electrical component housing to block the ventilation hole so that air can pass therethrough, and is supported by one side of the hydraulic valve block; and a vent sealing member that seals a space between the hydraulic valve block and the electronic control device and surrounds the vent channel, the ventilation hole, and the filter.

The brake driving apparatus may further include a main sealing member formed along an edge of a surface of the electrical component housing facing the hydraulic valve block while sealing a space between the hydraulic valve block and the electronic control device.

The hydraulic valve block may have a valve installed therein to control a flow of brake oil, and the electronic control device may further include a printed circuit board accommodated in the inner space of the electrical component housing and generating an electrical signal for controlling the valve of the hydraulic valve block.

The brake driving apparatus may further include an electric motor supported on the other side of the hydraulic valve block and controlled by the electronic control device.

The filter includes a membrane filter.

The vent sealing member and the main sealing member may be made of a Cured In Place Gaskets (CIPG).

According to one embodiment of the present disclosure, the brake driving apparatus can stably maintain an equilibrium of internal pressure.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a brake driving device according to one embodiment of the present disclosure.

FIG. **2** is a partially enlarged perspective view of FIG. **1**.

FIG. **3** is a partially enlarged perspective view illustrating a portion indicated by F**3** in FIG. **2**.

FIG. **4** is a partial cross-sectional perspective view in which a portion of FIG. **3** is cut away.

FIG. **5** is a cross-sectional view illustrating a part of an electronic control device supported by the hydraulic valve block of FIG. **2**.

DETAILED DESCRIPTION

Hereinafter, an embodiment of the present disclosure will be described in detail with reference to the accompanying drawings so that those skilled in the art can easily carry out the present disclosure. The present disclosure may be embodied in many different forms and is not limited to the embodiment set forth herein.

It should be noted that the drawings are schematic and not drawn to scale. Relative dimensions and proportions of parts in the drawings are illustrated exaggerated or reduced in size for clarity and convenience in the drawings, and any dimensions are illustrative only and not limiting. Moreover, the same structure, element or part appearing in two or more drawings will have the same reference number used to indicate like features.

The embodiment of the present disclosure specifically represents an ideal embodiment of the present disclosure. As a result, various variations of the drawings are expected. Therefore, the embodiment is not limited to the specific shape of the illustrated area, and includes, for example, modification of the shape by manufacturing.

In addition, all technical terms and scientific terms used in the present disclosure have meanings commonly understood by those of ordinary skill in the art to which the present disclosure belongs, unless otherwise defined. All terms used herein are selected for the purpose of more clearly describing the present disclosure and are not selected to limit the scope of rights according to the present disclosure.

In addition, expressions such as "comprising", "including", "having", or the like used in the present disclosure should be understood in open-ended terms that imply the

possibility of including other embodiments, unless otherwise stated in the phrase or sentence in which the expressions are included.

In addition, singular expressions described in the present disclosure may include plural meanings unless otherwise stated, and this applies to singular expressions described in the claims as well.

Hereinafter, a brake driving apparatus **101** according to one embodiment of the present disclosure will be described with reference to FIGS. **1** to **5**.

The brake driving device **101** converts a pedal effort of a brake pedal into a constant braking pressure required for braking, and provides the converted brake pressure to the vehicle to brake the vehicle.

Specifically, as illustrated in FIGS. **1** and **2**, the brake driving apparatus **101** includes an electronic control device (ECU) **110**, a hydraulic valve block **120**, and an electric motor **130**.

In addition, in the brake driving apparatus **101**, a mounting bracket **150** is supported by the vehicle, and a brake pedal is installed in an input rod **160** to receive the pedal effort from a driver.

A valve for controlling a flow of the brake oil is installed inside the hydraulic valve block **120**, and a channel controlled by the valve may be formed therein. Here, the valve may control the supply of the brake oil through the channel. Specifically, the valve installed inside the hydraulic valve block **120** may operate according to an electrical signal input from an electronic control device **110** to be described later to control the flow of the brake oil.

In addition, in one embodiment of the present disclosure, a vent channel **129** (illustrated in FIG. **5**) for discharging air to the outside may be formed in the hydraulic valve block **120**.

The electronic control device **110** may receive information from sensors capable of detecting the pedal effort or a pedal displacement of the pedal or the like. The electronic control device **110** may include a printed circuit board (PCB) that generate an electrical signal for controlling the valve built in the hydraulic valve block **120** and the electric motor **130** to be described later, an electrical component housing **300** that accommodates the printed circuit board in the internal space, and a filter **400** that is attached to the electrical component housing **300**. Moreover, the electronic control device **110** may be supported by one side of the hydraulic valve block **120**.

As illustrated in FIGS. **3** to **5**, the electrical component housing **300** may have a ventilation hole **340** that is opened in a direction of the vent channel **129** of the hydraulic valve block **120** and formed to be connected to the internal space.

For reference, FIG. **3** illustrates an area indicated by F**3** in FIG. **2**, and FIG. **4** illustrates the internal structure of the electrical component housing **300** by cutting a part of FIG. **3**. Moreover, FIG. **5** illustrates a part of the electronic control device **110** supported by the hydraulic valve block **120**.

The filter **400** is attached to the electrical component housing **300** to block the ventilation hole **340** so that air can pass therethrough. As an example, the filter **400** may be a membrane filter. The membrane filter **400** is a breathable filter that can transmit air.

In addition, the filter **400** may be attached to the electrical component housing **300** using various methods such as adhesive.

The filter **400** prepared in this way communicates the inside of the electrical component housing **300** with the outside through the vent channel **129** of the hydraulic valve block **120** to suppress a change in internal pressure according to the operation of the electronic control device **110** and stably maintain an equilibrium of the internal pressure.

Meanwhile, when the equilibrium of the internal pressure of the electrical component housing **300** cannot be maintained, due to heat generated by the printed circuit board of the electronic control device **110** that controls the valve of the hydraulic valve block **120** and the electric motor **130** to be described late, the internal pressure rises excessively, and the printed circuit board of the electronic control device **110** may be damaged or a lifespan thereof may be reduced.

A vent sealing member **840** seals a space between the hydraulic valve block **120** and the electronic control device **110**, and may be formed to surround the vent channel **129**, the ventilation hole **340**, and the filter **400**.

Accordingly, the vent sealing member **840** may protect the filter **400** and prevent the vent channel **129** from being blocked.

For example, in a process in which air discharged to the ventilation hole **340** of the electrical component housing **300** passes through the filter **400** and heads to the vent channel **129** of the hydraulic valve block **120**, the vent sealing member **840** prevent the air from leaking to other places. Moreover, the vent sealing member **840** prevents air, moisture, oil, dust, or foreign substances from other places from adhering to the filter **400** and contaminating the filter **400** and prevents the air, moisture, oil, dust, or foreign substance blocking the vent channel **129** or from being introduced into the electronic control device **110** or hydraulic valve block **120**.

The main sealing member **830** may seal the space between the hydraulic valve block **120** and the electronic control device **110**, and the electrical component housing **300** may be formed along the edge of the surface facing the hydraulic valve block **120**.

In this way, the main sealing member **840** seals one side of the electrical component housing **300** in contact with the hydraulic valve block **120**, and thus, can prevent moisture, oil, dust, or foreign substances from being introduced into the electronic control device **110** or the hydraulic valve block **120**.

The electric motor **130** may be supported by the other side of the hydraulic valve block **120**. In addition, the electric motor **130** may be controlled by a signal transmitted from the electronic control device **110**. Specifically, the electric motor **130** may be supported by a surface opposite to one surface of the hydraulic valve block **120** facing the electronic control device **110**.

With this configuration, the brake driving apparatus **101** according to one embodiment of the present disclosure can stably maintain the equilibrium of the internal pressure.

Specifically, the brake driving apparatus **101** according to one embodiment of the present disclosure communicates the inside of the electronic control device **110** with the outside to suppress the change in the internal pressure caused by the operation of the electronic control device **110** and stably maintain the equilibrium of the internal pressure.

That is, by maintaining the equilibrium of the internal pressure of the electronic control device **110**, it is possible suppress an excessive increase in the internal pressure of the electronic control device **110** due to the heat of the printed circuit board of the electronic control device **110** that controls the valves of the electric motor **130** and hydraulic valve block **120**, and thus, it is possible to prevent damages of the printed circuit board or decrease in the lifespan.

Although the embodiment of the present disclosure has been described with reference to the accompanying drawings, those skilled in the art to which the present disclosure

pertains can understand that the present disclosure can be implemented in other specific forms without changing the technical spirit or essential features.

Therefore, the embodiment described above should be understood as illustrative in all respects and not limiting, and the scope of the present invention is indicated by the claims to be described later, and all changes or modifications derived from the meaning and scope of the claims and their equivalent concepts should be construed as being included in the scope of the present invention.

DETAILED DESCRIPTION OF MAIN ELEMENTS

101: brake driving apparatus
110: electronic control device
120: hydraulic valve block
129: vent channel
130: electric motor
150: mounting bracket
160: input rod
300: electrical component housing
340: ventilation hole
400: filter
830: main sealing member
840: vent sealing member

What is claimed is:

1. A brake driving apparatus comprising:

a hydraulic valve block including a vent channel for discharging air to the outside;

an electronic control device that includes an electrical component housing open in a direction of the vent channel of the hydraulic valve block and having a ventilation hole and a filter attached to the electrical component housing to block the ventilation hole so that air can pass therethrough, and is supported by one side of the hydraulic valve block; and

a vent sealing member that seals a space between the hydraulic valve block and the electronic control device and surrounds the vent channel, the ventilation hole, and the filter.

2. The brake driving apparatus of claim **1**, further comprising a main sealing member formed along an edge of a surface of the electrical component housing facing the hydraulic valve block while sealing the space between the hydraulic valve block and the electronic control device.

3. The brake driving apparatus of claim **2**, wherein the vent sealing member and the main sealing member are made of Cured In Place Gaskets (CIPG).

4. The brake driving apparatus of claim **1**, wherein the hydraulic valve block has a valve installed therein to control a flow of brake oil, and

the electronic control device further includes a printed circuit board accommodated in an inner space of the electrical component housing and generating an electrical signal for controlling the valve of the hydraulic valve block.

5. The brake driving apparatus of claim **4**, further comprising an electric motor supported on the other side of the hydraulic valve block and controlled by the electronic control device.

6. The brake driving apparatus of claim **1**, wherein the filter includes a membrane filter.

* * * * *